Discovery and initial characterization of members of the new YaaH family of microbial acetate transporters

Joana Sá Pessoa[1], Sandra Viegas[2], Gabriel Rocha[1], George Diallinas[3], Sandra Paiva[1], Cecilia Arraiano[2], Margarida Casal[1]

[1]CBMA, Dept. of Biology, University of Minho, Portugal; [2]ITQB, UNL, Lisboa, Portugal; [3]Faculty of Biology, University of Athens, Athens, Greece;joanapessoa@bio.uminho.pt

The emergence of probiotics and prebiotics has revived the importance of short-chain fatty acids (SCFAs) associated to colonic and systemic health improvement. Although biosynthesis and degradation of SCFAs and other short-chain carboxylic acids, such as lactate, pyruvate or citrate are well understood, the transport of these acids is still a matter of discussion. The presence of SCFAs transporters in cellular membranes is ubiquitous, displaying great level of homology among Bacteria, Archaea and Eukaryotes, indicating the ancient nature of these transporters and their high level of conservation. The mechanism of substrate uptake of these transporters including specificity, kinetics and bioenergetic studies is a field poorly explored.

This work constitutes a first approach to establish the mode of action of the SCFA transporters specifically those belonging to the YaaH family. The YaaH family, (TC# 2.A.96, http://www.tcdb.org/tcdb) is presumed to be a family of acetate

transporters. Its members possess 6 putative transmembrane span domains and are spread by the 3 domains of life: Bacteria, Eukaryotes and Archaea. This work aims at studying the YaaH protein from *E. coli* as well as it homologues from the yeast *Saccharomyces cerevisiae* (ScAdy2) and the fungi *Aspergillus nidulans* (AcpA).

We have constructed a disrupted *E. coli* strain in the yaaH gene showing that the yaaH mutant cells are compromised for the uptake of the labelled acetic acid in comparison with the isogenic wt strain. This is the first experimental data that demonstrates the physiological role of the yaaH gene in the transport of acetate in bacteria.

Using the yeast and fungi strains we were able to measure the kinetic parameters associated with these transporters and assign a specificity profile to this family. These transporters are specific primarily to acetate and are inhibited by other short chain acids such as benzoic, formic, propionic and butyric acids.

Acknowledgments:

This work was supported by FEDER through POFC – COMPETE and by national funds from FCT - project PEst-C/BIA/UI4050/2011. J.S.P. received a FCT PhD grant SFRH/BD/61530/2009, co-funding by FSE in the scope of QREN/POPH.